

IN-MEDIUM LIFETIMES OF UNSTABLE PARTICLES

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ABSTRACT

At the boundary of nuclear and particle physics research, current experiments at Brookhaven National Laboratory's Relativistic Heavy-Ion Collider (RHIC) involve collisions of gold nuclei at center-of-mass energies of 200 GeV per nucleon. Scientists study glimpses of strongly-interacting many-body systems very far from the ground state. The reaction zone reaches tremendous densities (ten times normal nuclear matter) and impressive temperatures (about a trillion Kelvin). Protons and neutrons are expected to "melt" under these conditions. In addition to the nucleons involved in the reactions, thousands of subatomic particles are produced in each event. The final state is affected in identifiable ways by individual particle properties. We model the in-medium spectral functions for the omega and phi mesons and calculate their modified lifetimes. In free space, both particles outlive the expanding fireball. We attempt to answer the question, "will the particles decay inside or outside the fireball, given their modified lifetimes?". If they decay inside, the particles will carry valuable information on nuclear smearing effects; if they decay outside, the particles will not be useful probes.